

## **Assessing the vulnerability of coastal lowlands to marine flooding using LiDAR data, Sangatte coastal dunes, northern France**

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**Summary.** Coastal erosion is common along the unconsolidated shoreline of northern France where coastal dunes frequently form a natural barrier protecting the reclaimed lands of the coastal plain from marine flooding. A study was conducted on the Sangatte coastal dunes, west of the town of Calais in the Dover Strait, in order to assess the vulnerability of the coastal zone to extreme flooding events. The study combines geomorphology-based and statistical methodologies by using terrain elevation and extreme water level data derived from telemetric and tide-gauge measurements. Tide-gauge data from 1965 to 2001 were used to estimate the heights of extreme water levels with return periods of 10, 50 and 100 years by the year 2050, including projected mean sea level rise. Airborne scanning LiDAR (Light Detection and Ranging) data were collected over an area of approximately 14 km<sup>2</sup> and were used to produce potential flood maps for extreme water levels based on high-resolution Digital Elevation Models. The results show that a low area to the east could be overtopped by high water levels if a significant storm surge occurs at high tide. In the western part of the dune system, crest elevations are significantly higher, preventing marine water incursions, but the foredune being much narrower in that area, marine erosion may lead to breaching and eventually flooding in the near future. This study demonstrates the interest of airborne LiDAR for coastal management issues by providing accurate topographic mapping over extensive areas and identifying the zones that are the most sensitive to coastal hazards.